

**ABSTRACT**

Shortening impulse response filters (SIRF) are disclosed that satisfy constraints in both the time and frequency domains. In addition, methods and apparatus are disclosed for determining the coefficient values for SIRF filters. The disclosed SIRF filters shorten the channel impulse response in the time domain while also providing a frequency response that does not attenuate or amplify the received signal. One or more sets define constraints that the SIRF filter must satisfy in the time domain, and one or more sets define constraints that the SIRF filter must satisfy in the frequency domain. By varying the sets utilized to define the time and frequency domain constraints, SIRF filters having a linear or non-linear phase response may be obtained. The intersection of the various sets defines the coefficients for the SIRF filters. Vector space projection methods are utilized to determine the intersection set.

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